



US 20060037170A1

(19) **United States**(12) **Patent Application Publication**
Shimizu(10) **Pub. No.: US 2006/0037170 A1**(43) **Pub. Date: Feb. 23, 2006**(54) **SELF-PROPELLING CLEANER****Publication Classification**(75) Inventor: **Akitaka Shimizu**, Osaka (JP)(51) **Int. Cl.****A47L 5/00** (2006.01)(52) **U.S. Cl.** **15/319**

Correspondence Address:

OSHA LIANG L.L.P.**1221 MCKINNEY STREET****SUITE 2800****HOUSTON, TX 77010 (US)**

(57)

ABSTRACT(73) Assignee: **Funai Electric Co., Ltd.**, Osaka (JP)(21) Appl. No.: **11/055,726**(22) Filed: **Feb. 10, 2005**(30) **Foreign Application Priority Data**

Feb. 10, 2004 (JP) JP2004-032917

A self-propelling cleaner 1 performs dust removal processing in which a comb is brought close to a rotary brush with prescribed timing and dust is removed from the rotary brush. In the dust removal processing, the comb is slid in such a direction as to come closer to the brush, even dust that is stuck to the base portions of bristles of the rotary brush can be removed. A self-propelling cleaner is provided that is free of an event that it performs cleaning in a state that a large amount of dust is stuck to the rotary brush.

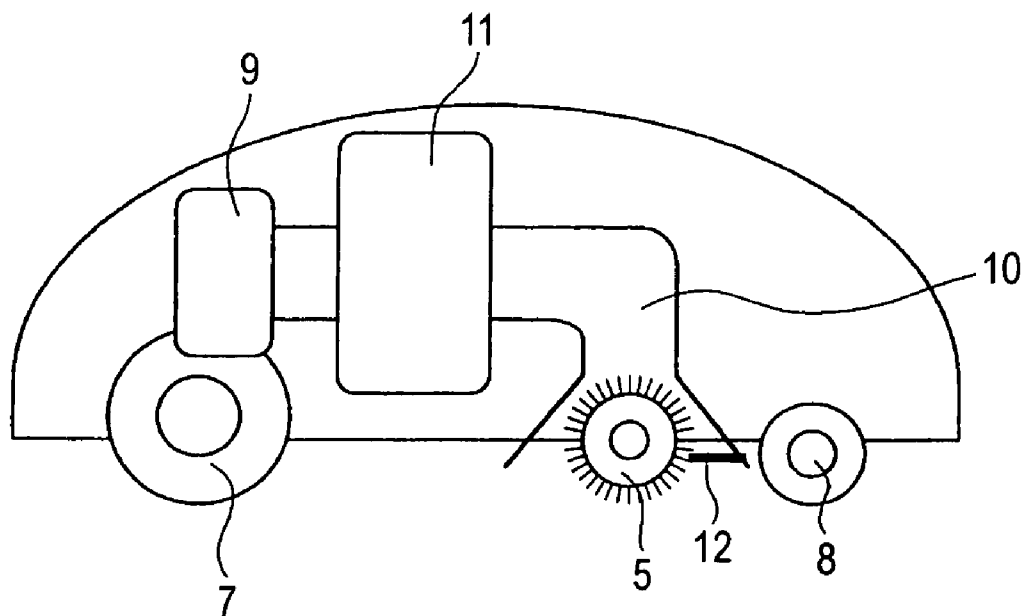


FIG. 1

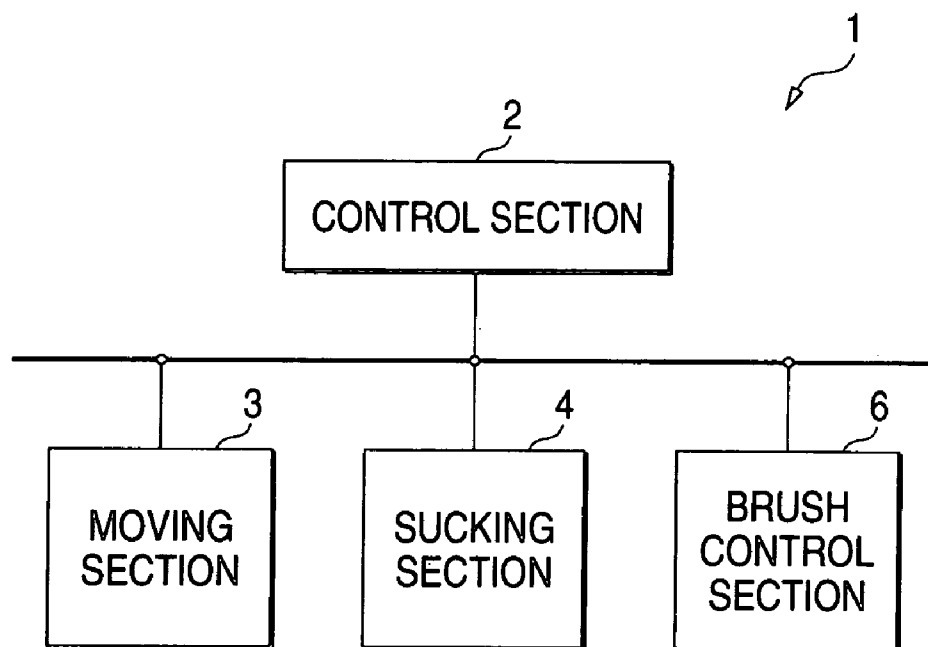


FIG. 2A

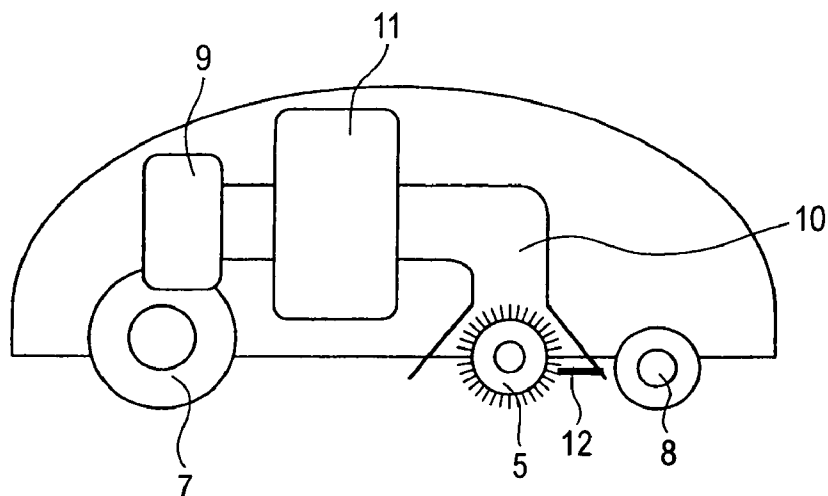


FIG. 2B

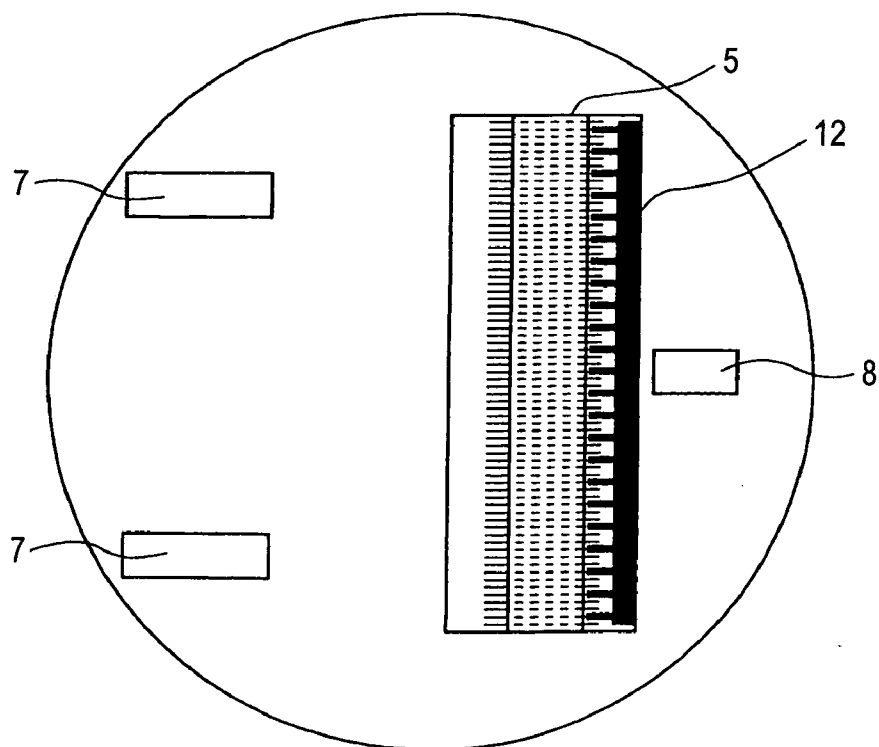
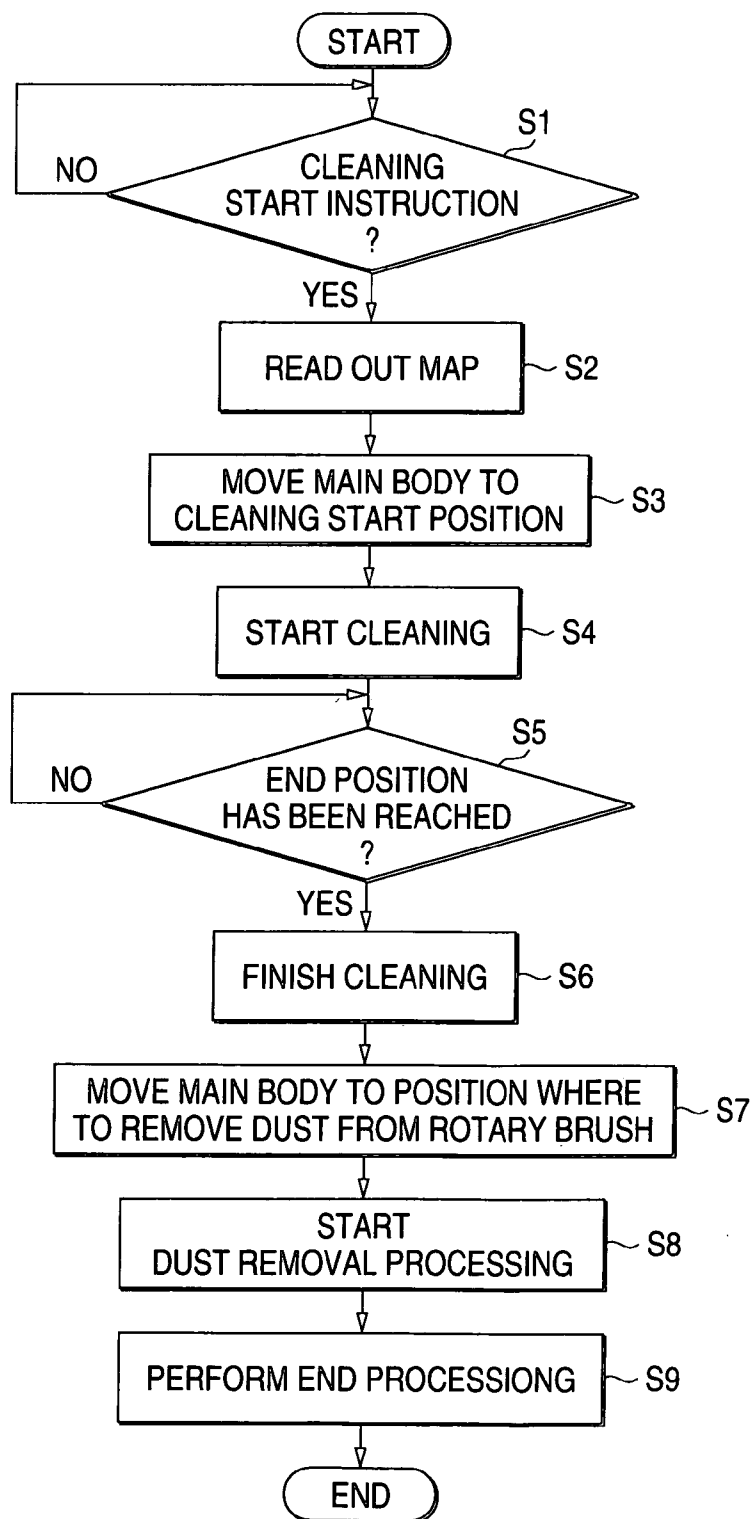
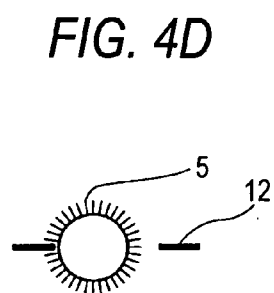
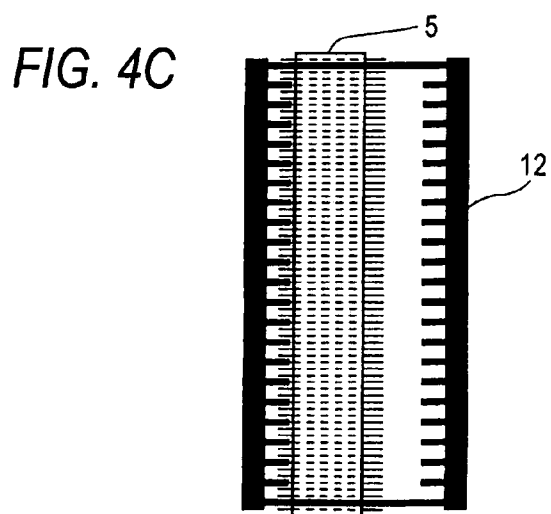
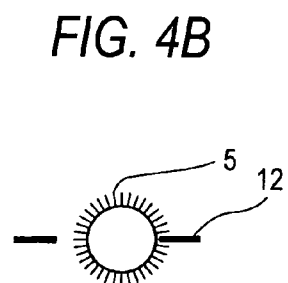
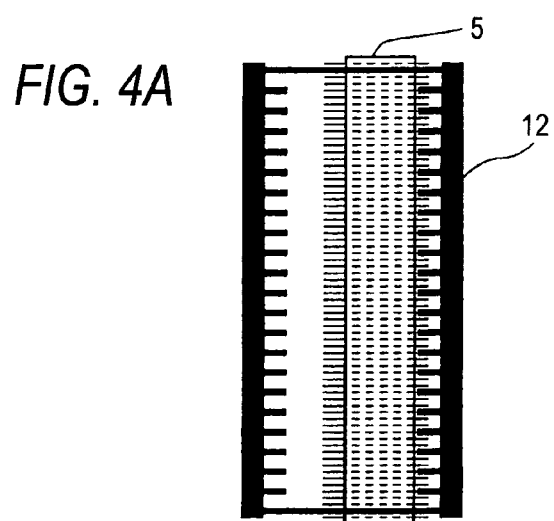


FIG. 3





SELF-PROPELLING CLEANER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a self-propelling cleaner that cleans a cleaning area while moving therein automatically.

[0003] 2. Description of the Related Art

[0004] Among conventional vacuum cleaners are ones in which a suction mouth is provided with a rotary brush for kicking up dust on the floor and dust kicked up by the rotary brush is sucked through the suction mouth. Since the rotary brush kicks up dust on the floor, dust tends to stick to its surfaces. In view of this, JP-A-11-137488 proposes a technique for decreasing the amount of dust that is stuck to the rotary brush. In the technique proposed in JP-A-11-137488, air intake portions are provided at both ends of the rotary brush and its outer circumferential surface is formed with blowholes. A sucked air flow that has been introduced into the rotary brush through the air intake portions flows out through the blowholes. The air that flows through the blowholes serves as a barrier for suppressing dust sticking to the rotary brush. In recent years, self-propelling cleaners have been proposed that perform cleaning while moving automatically.

SUMMARY OF THE INVENTION

[0005] However, conventional vacuum cleaners are not equipped with any structure for removing dust that is stuck to the rotary brush and users are required to manually remove dust that is stuck to the rotary brush. In the case of non-self-propelling cleaners, if dust falls off the rotary brush during cleaning, a user who is doing the cleaning would recognize that a large amount of dust is stuck to the rotary brush and suspend the cleaning to remove the dust from the rotary brush. Therefore, cleaning is not performed in a state that a large amount of dust is stuck to the rotary brush. On the other hand, in the case of self-propelling cleaners, a user tends to be absent because he or she acts irrespective of cleaning being performed by a self-propelling cleaner and hence would not notice a fall of dust from the rotary brush during cleaning. As a result, the self-propelling cleaner continues to move while dropping dust from the rotary brush, to cause a situation that the room is scattered with pieces of dust that have fallen off the rotary brush, that is, the room is not cleaned. Such a situation can be avoided by removing dust from the rotary shaft regularly. However, there is a problem that this is a heavy work load to the user.

[0006] One of objects of the present invention is to provide a self-propelling cleaner that prevents an event that cleaning is performed in a state that a large amount of dust is stuck to the rotary brush by thoroughly removing dust from the rotary brush with prescribed timing, and to thereby allow a user to manipulate the self-propelling cleaner with greater ease.

[0007] According to a first aspect of the invention, there is provided a self-propelling cleaner including: a main body; a self-propelling section that propels the main body autonomously; a sucking section provided with a suction mouth and a suction fan, and collects dust into the main body through the suction mouth by rotating the suction fan; a

rotating section that rotates a rotary brush that is rotatably attached to the suction mouth; a comb provided adjacent to the rotary brush to be slidable in a direction as to be brought into contact with and separated from the rotary brush; a cleaning section that controls the self-propelling section and the sucking section to perform cleaning while propelling the main body within a preset cleaning area; and a dust removing section that removes dust attached to the comb by causing the sucking section to rotate the suction fan and causing the rotating section to rotate the rotary brush while sliding the comb to be in contact with the rotary brush, after completion of the cleaning by the cleaning section.

[0008] According to a second aspect of the invention, there is provided a self-propelling cleaner including: a main body; a self-propelling section that propels the main body autonomously; a sucking section provided with a suction mouth and a suction fan, and collects dust into the main body through the suction mouth by rotating the suction fan; a rotating section that rotates a rotary brush that is rotatably attached to the suction mouth; a comb provided adjacent to the rotary brush to be slidable in a direction as to be brought into contact with and separated from the rotary brush; a cleaning section that controls the self-propelling section and the sucking section to perform cleaning while propelling the main body within a preset cleaning area; and a dust removing section that removes dust attached to the comb, at a prescribed timing, by causing the sucking section to rotate the suction fan and causing the rotating section to rotate the rotary brush while sliding the comb to be in contact with the rotary brush.

[0009] According to a third aspect of the invention, there is provided a self-propelling cleaner including: a main body; a self-propelling section that propels the main body autonomously; a sucking section provided with a suction mouth and a suction fan, and collects dust into the main body through the suction mouth by rotating the suction fan; a rotating section that rotates a rotary brush that is rotatably attached to the suction mouth; a comb having teeth thereof on both sides that are opposed to each other with respect to the rotary brush interposed therebetween, and provided adjacent to the rotary brush to be slidable in a direction perpendicular to a rotation axis of the rotary brush as to be brought into contact with and separated from the rotary brush; a cleaning section that controls the self-propelling section and the sucking section to perform cleaning while propelling the main body within a preset cleaning area in a state where the teeth of the comb provided at rear to a direction of the propelling of the main body are in contact with the rotary brush; and a dust removing section that removes dust attached to the comb, at a prescribed timing, by causing the sucking section to rotate the suction fan and causing the rotating section to rotate the rotary brush in a reverse direction while sliding the comb to be in a state where the teeth of the comb provided at front to the direction of the propelling of the main body are in contact with the rotary brush.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above objects and advantages of the present invention will become more apparent by describing preferred exemplary embodiments thereof in detail with reference to the accompanying drawings, wherein:

[0011] FIG. 1 is a block diagram showing the configuration of a self-propelling cleaner according to an embodiment of the present invention;

[0012] FIGS. 2A and 2B are schematic diagrams of the self-propelling cleaner 1 according to the embodiment of the invention; wherein FIG. 2A is a side sectional view and FIG. 2B is a bottom view.

[0013] FIG. 3 is a flowchart showing the operation of the self-propelling cleaner 1 according to the embodiment; and

[0014] FIGS. 4A-4D are schematic diagrams showing positional relationships between a brush and combs of a self-propelling cleaner 1 according to another embodiment of the invention; wherein FIG. 4A is a bottom view in a cleaning state, FIG. 4B is a side sectional view in the cleaning state, FIG. 4C is a bottom view in a dust removal state, and FIG. 4D is a side sectional view in the dust removal state.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] FIG. 1 is a block diagram showing the configuration of a self-propelling cleaner according to an embodiment of the present invention. FIGS. 2A and 2B are schematic diagrams of the self-propelling cleaner 1 according to the embodiment of the invention; wherein FIG. 2A is a side sectional view and FIG. 2B is a bottom view. The self-propelling cleaner 1 includes a control section 2 for controlling operation of the main body, a moving section 3 for controlling the rotation speeds of tires individually, a sucking section 4 for sucking dust into the main body through a suction mouth that is provided in the main body by rotating a suction fan, and a brush control section (dust removing section) 6 for kicking up dust on a floor or removing dust from a rotary brush 5 that is attached to the suction mouth by controlling the rotation direction of the rotary brush 5. The control section 2 stores a map that contains information indicating along what route the self-propelling cleaner should be moved in cleaning, and other information. A user can freely input information relating to the map. The moving section 3 performs, according to an instruction from the control section 2, a rotation control on a motor for rotating driving wheels 7 that move the main body. The driving wheels 7 are a pair of wheels that are opposed to each other with a proper interval. The moving section 3 controls the movement direction of the main body by controlling the rotation directions and rotation speeds of the two driving wheels 7 individually by a known PWM control. Reference numeral 8 denotes a follower wheel that is provided to secure sufficient stability of movement of the main body. The suction mouth is provided between the follower wheel 8 and the driving wheels 7, and the rotary brush 5 is attached to the suction mouth. The moving section 3 controls the movement direction of the self-propelling cleaner 1 by controlling the rotation speeds of the right and left driving wheels 7 individually. The sucking section 4 produces sucking force at the suction mouth by rotating the suction fan 9. Dust that is sucked through the suction mouth is sent to a dust room 11 through a dust transport pipe 10. During cleaning, the brush control section 6 kicks up dust on the floor by rotating the rotary brush 5 in the normal direction. To remove dust from the rotary brush 5, the brush control section 6 slides a comb 12 in such a direction that it comes

closer to the rotary brush 5, and rotates the rotary brush 5 in the normal direction. While the rotary brush 5 is rotating in the normal direction, it is rotating in the same direction as the driving wheels rotate when the main body advances.

[0016] Next, the operation of the self-propelling cleaner 1 according to the embodiment (first embodiment) will be described. FIG. 3 is a flowchart showing the operation of the self-propelling cleaner 1 according to the embodiment of the invention. First, the self-propelling cleaner 1 waits for a cleaning start instruction (S1). A cleaning start instruction can be input to the self-propelling cleaner 1 by performing a prescribed manipulation on a manipulation section or a remote controller (not shown). If judging at step S1 that a cleaning start instruction has been received, the self-propelling cleaner 1 reads out the map that is stored in the control section 2 (S2). The map contains information indicating a start point and end point of cleaning and a movement route to be taken by the main body to move from the start point to the end point. Then, the self-propelling cleaner 1 moves the main body to the cleaning start position (S3). The cleaning start position is a position that is indicated by the map that was read out by the control section 2 at step S2. The moving section 3 moves the main body to the cleaning start position by rotating the driving wheels 7. The self-propelling cleaner 1 does not rotate the suction fan while the main body is moving toward the cleaning start position.

[0017] The self-propelling cleaner starts cleaning when the main body has reached the cleaning start position (S4). At step S4, the control section 2 instructs the moving section 3 to move the main body along the movement route from the cleaning start position to the end position that is indicated by the map that was read out at step S2. Further, the control section 2 instructs the brush control section 6 to start rotating the rotary brush 5 in the normal direction and also instructs the sucking section 4 to start rotating the suction fan 9. The self-propelling cleaner 1 cleans the cleaning area of this time as the main body moves from the cleaning start position to the end position in this state.

[0018] When the main body has reached the cleaning end position, the self-propelling cleaner finishes the cleaning that was started at step S4 (S5 and S6). At this time, the control section 2 stops the movement of the main body by issuing, to the moving section 3, an instruction to finish the movement. Further, the control section 2 causes the brush control section 6 to stop the rotation of the rotary brush 5 and causes sucking section 4 to stop the rotation of the suction fan 9. Then, the control section 2 instructs the moving section 3 to move the main body to a position where to remove dust from the rotary brush 5 (S7). The dust removal position may be a predetermined position. However, it is preferable that the dust removal position be located in the cleaning area that has been cleaned this time, because it is preferable that the dust removal position be a relatively clean position that is free of a risk that new dust sticks to the rotary brush 5 during a subsequent operation of removing dust from the rotary brush 5. For example, the dust removal position may be a position that the main body reaches as a result of the moving section 3's turning it by 180°. The moving section 3 moves the main body to the dust removal position in the same manner as at step S3. Dust removal processing is performed as soon as the main body reaches the dust removal position (S8).

[0019] The dust removal processing is as follows. After the brush control section 6 has moved the comb 12 close to the rotary brush 5 according to an instruction from the control section 2, a state that the brush control section 6 rotates the suction fan and the sucking section 4 rotates the suction fan according to instructions from the control section 2 is maintained for a prescribed time. The prescribed time may be set freely by a user, and may be about one minute which is sufficiently long.

[0020] Since the suction fan is rotated, dust that has been untangled as a result of the brush's hitting the comb is sucked and does not fall. Further, since the comb is slid in such a direction as to come closer to the brush, even dust that is stuck to the base portions of bristles of the rotary brush can be removed and hence the rotary brush can be made clean. Still further, when the dust removal is performed (performed after the completion of cleaning), not much dust is entangled with the rotary brush and hence the dust that is stuck to the rotary brush can be removed thoroughly. That is, the dust that is stuck to the rotary brush 5 can be removed automatically and hence a user can manipulate the vacuum cleaner with greater ease.

[0021] After completion of step S8, end processing for finishing the operation of cleaning the cleaning area that was specified this time (S9). The end processing of step S9 is processing of causing the moving section 3 to move the main body to a standby position. For example, the standby position is a place where a charger for a battery (not shown) of the main body is installed. Although in this embodiment the dust removal is performed after the completion of cleaning, it may be performed at any time such as before or during cleaning.

[0022] Next, a self-propelling cleaner 1 according to another embodiment of the invention will be described. The self-propelling cleaner according to this embodiment is different than in the above embodiment in that combs are provided on both sides of the rotary brush 5 so as to be slidable in the forward-rear direction with respect to the propelling direction of the main body (see FIGS. 4A-4D). The self-propelling cleaner according to this embodiment is also configured as to automatically perform dust removal processing for removing dust that is stuck to the rotary brush. FIGS. 4A and 4B show a positional relationship between the rotary brush and the combs during cleaning, and FIGS. 4C and 4D show a positional relationship between the rotary brush and the combs during dust removal processing. During cleaning, the rotary brush 5 hits the comb that is located in front of the main body and removes dust that is stuck to the rotary brush. In this state, the rotary brush does not hit the comb that is located at the rear of the main body. On the other hand, during dust removal, the rotary brush 5 hits the comb that is located at the rear of the main body and removes dust that is stuck to the rotary brush. In this state, the rotary brush does not hit the comb that is located in front of the main body.

[0023] The operation of the self-propelling cleaner according to this embodiment is almost the same as that according to the above-described embodiment but is different from the latter in the dust removal processing of step S8.

[0024] After executing steps S1-S6 in the same manner as in the above-described embodiment, at step S7 the self-propelling cleaner 1 moves the main body to the position

where to remove dust from the rotary brush. When the main body has just been moved to the dust removal position, the rotary brush is in the state of FIGS. 4A and 4B. First, the self-propelling cleaner 1 slides the combs forward to establish the state of FIGS. 4C and 4D. In this state, the rear comb is brought into contact with the base portions of bristles of the rotary brush. Then, dust is removed by rotating the rotary brush in the reverse direction and rotating the suction fan.

[0025] This dust removal processing provides the same advantages as in the above-described embodiment. In addition, since the rotary brush 5 is rotated in the opposite direction to the direction employed during cleaning, dust that has been entangled with the rotary brush 5 during cleaning is untangled easily and hence the rotary brush 5 can be cleaned more thoroughly.

[0026] As described above, according to the embodiment, since the dust removing section slides the comb in such a direction that the comb comes closer to the rotary brush and rotates the rotary brush, even dust that is stuck to the base portions of bristles of the rotary brush can be removed and hence the dust that is stuck to the rotary brush can be removed thoroughly. The dust is sucked by the rotation of the suction fan. In this manner, dust is automatically removed from the rotary brush with prescribed timing. A user can therefore manipulate the vacuum cleaner with greater ease.

[0027] According to the embodiment, during cleaning, dust is removed by bringing the rotary brush close to the rotation-direction-side teeth of the comb. The term "rotation-direction-side teeth of the comb" means the teeth that are hit by the bristles of the rotating rotary brush downward. Further, dust that is stuck to the rotary brush is removed with prescribed timing by rotating the rotary brush in the opposite direction to the direction employed during cleaning in a state that the dust removing section is rotating the suction fan. In this operation, since the rotary brush is rotated in the reverse direction, dust that has been entangled with the rotary brush during cleaning is untangled and sucked by the rotation of the rotary fan. In this manner, dust is automatically removed from the rotary brush with prescribed timing. A user can therefore manipulate the vacuum cleaner with greater ease.

[0028] According to the embodiment, when the dust removal is performed (performed after the completion of cleaning) not much dust is entangled with the rotary brush and hence the dust that is stuck to the rotary brush can be removed thoroughly.

[0029] In the self-propelling cleaner according to the embodiment, since dust is automatically removed from the rotary brush with prescribed timing (e.g., after the completion of cleaning), a user can manipulate the vacuum cleaner with greater ease.

[0030] Although the present invention has been shown and described with reference to a specific preferred embodiment, various changes and modifications will be apparent to those skilled in the art from the teachings herein. Such changes and modifications as are obvious are deemed to come within the spirit, scope and contemplation of the invention as defined in the appended claims.

What is claimed is:

1. A self-propelling cleaner comprising:

- a main body;
 - a self-propelling section that propels the main body autonomously;
 - a sucking section provided with a suction mouth and a suction fan, and collects dust into the main body through the suction mouth by rotating the suction fan;
 - a rotating section that rotates a rotary brush that is rotatably attached to the suction mouth;
 - a comb provided adjacent to the rotary brush to be slidable in a direction as to be brought into contact with and separated from the rotary brush;
 - a cleaning section that controls the self-propelling section and the sucking section to perform cleaning while propelling the main body within a preset cleaning area; and
 - a dust removing section that removes dust attached to the comb by causing the sucking section to rotate the suction fan and causing the rotating section to rotate the rotary brush while sliding the comb to be in contact with the rotary brush, after completion of the cleaning by the cleaning section.
2. A self-propelling cleaner comprising:
- a main body;
 - a self-propelling section that propels the main body autonomously;
 - a sucking section provided with a suction mouth and a suction fan, and collects dust into the main body through the suction mouth by rotating the suction fan;
 - a rotating section that rotates a rotary brush that is rotatably attached to the suction mouth;
 - a comb provided adjacent to the rotary brush to be slidable in a direction as to be brought into contact with and separated from the rotary brush;
 - a cleaning section that controls the self-propelling section and the sucking section to perform cleaning while propelling the main body within a preset cleaning area; and
 - a dust removing section that removes dust attached to the comb, at a prescribed timing, by causing the sucking

section to rotate the suction fan and causing the rotating section to rotate the rotary brush while sliding the comb to be in contact with the rotary brush.

3. The self-propelling cleaner according to claim 2, wherein the dust removing section removes dust attached to the comb after completion of the cleaning by the cleaning section.

4. A self-propelling cleaner comprising:

- a main body;
- a self-propelling section that propels the main body autonomously;
- a sucking section provided with a suction mouth and a suction fan, and collects dust into the main body through the suction mouth by rotating the suction fan;
- a rotating section that rotates a rotary brush that is rotatably attached to the suction mouth;
- a comb having teeth thereof on both sides that are opposed to each other with respect to the rotary brush interposed therebetween, and provided adjacent to the rotary brush to be slidable in a direction perpendicular to a rotation axis of the rotary brush as to be brought into contact with and separated from the rotary brush;
- a cleaning section that controls the self-propelling section and the sucking section to perform cleaning while propelling the main body within a preset cleaning area in a state where the teeth of the comb provided at rear to a direction of the propelling of the main body are in contact with the rotary brush; and
- a dust removing section that removes dust attached to the comb, at a prescribed timing, by causing the sucking section to rotate the suction fan and causing the rotating section to rotate the rotary brush in a reverse direction while sliding the comb to be in a state where the teeth of the comb provided at front to the direction of the propelling of the main body are in contact with the rotary brush.

5. The self-propelling cleaner according to claim 4, wherein the dust removing section removes dust attached to the comb after completion of the cleaning by the cleaning section.

* * * * *